

these terms were originally applied. But *bimorphous* and *trimorphous* are objectionable, not only on account of the clumsy and hybrid character of the former, but because they may be taken to imply, by analogy with the use of the terminations *ous* and *ic* in chemistry, some relation with the phenomenon of dimorphism. The Latin equivalents *biformed* and *triformed* proposed by Rhumbler<sup>1</sup> are far preferable.

The most valuable part of the book as a contribution to the literature of the Foraminifera is the chapter on their geological range. Twenty years ago, Schwager summarised the information which had been accumulated on this head in the article appended to Bütschli's account of the Sarcodina in Bronn's Thier-reich. Since that date our knowledge has greatly extended, and to no inconsiderable extent as the result of Mr. Chapman's own investigations. The chapter ends with a tabular view of the range of the several families, in which it appears that all the main ones were represented in the Primary rocks, and that four of them (Textularidæ, Lagenidæ, Globigerinidæ and Rotalidæ) have been found in Cambrian strata.

The descriptive part of the book ends with useful practical directions, but no mention is made of the microaquarium, which has yielded such excellent results in the hands of Schaudinn, who invented it.<sup>2</sup>

The earlier chapters purport to give, as implied in the title, an introduction to the study of the Protozoa in general and of the Foraminifera in particular; and it is undoubtedly most desirable that workers in this group should have their eyes open to the general biological bearing of the phenomena which lie before them. To attain this end they must, however, go elsewhere. In these chapters there is no grasp of the problems presented, or of the conclusions which have been arrived at. On p. 11 we are told that the division of the nucleus "takes place either by the simple process of binary division or by the more complex and beautiful process of karyokinesis." The author thus ignores the process which has been observed in several of the higher forms (though it is, indeed, alluded to and figured further on), namely, the simultaneous breaking up of the nucleus or nuclei into fragments. Continuing the same sentence, the karyokinetic division of the nucleus is described as a process "in which the nuclear body is invested with strands of chromatin threads,"—whatever that may mean; but on turning to Fig. 10, which is given in illustration, we find two figures from Schaudinn's paper on the "Central-Korn" of the Heliozoa (*Verh. deutsch. zool. Gesellschaft*, Bonn, 1896), which represent stages, not of the karyokinetic division of the nucleus at all, but of the division of the central granule, a process preliminary to karyokinesis.

In chapter iv., on the shell structure of the Foraminifera, the author is more at home, but it opens with the statement that the arrangement of the segments of the shell is partially determined by the form of the initial or

primordial chambers. The primordial chambers, whether they be microspheric or megalospheric, are nearly always globular or ovoid, whatever the arrangement of the succeeding chambers may be. How then can the arrangement be in any degree determined by their form?

We cannot pass over the omission (p. 53) of the name of Max Schultze, the author of the classical work "Ueber den Organismus der Polythalamien," from the list of those who since Dujardin have been pioneer workers on the group.

On the whole it must be confessed that the book is written in a slipshod style, which in these earlier chapters is very marked; and in closing it one cannot but feel that the author would have been better advised if he had confined himself to the special treatment of the subject, for which he is well qualified, leaving the larger biological problems to other hands. J. J. L.

#### UNORGANISED FERMENTS.

*Enzymes and their Applications.* By J. Effront. Translated by S. C. Prescott, S.B. Vol. i. Pp. xi + 322. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd.) Price 12s. 6d.

IN his work on "Enzymes and their Applications," Dr. Effront has presented us with book of great interest and value. The book, as he explains in his preface, is "a summary of the course at the Institute of Fermentation of the New University of Brussels." If the lectures are delivered in the style in which the book is written, we should very much like to be among his students.

Judging from his definition of an enzyme, Dr. Effront is in practical agreement, although he does not say so, with those who class the enzymes among catalytic agents. His definition is as follows:—

"The enzymes, soluble ferments, zymases or diastases are active organic substances secreted by cells, and have the property, under certain conditions, of facilitating chemical reactions between certain bodies without entering into the composition of the definite products which result."

But although it seems appropriate to class the enzymes with catalytic agents, yet there are certain substances which appear to have a catalytic action upon the enzymes. For example, on p. 118 it is stated that the addition of 50 milligrams of asparagin to starch which has been treated with amylase increases the saccharification, in a given time, nearly seven-fold.

In chapter iii., which treats of the "Manner of Action of Diastases," the different theories advanced to explain diastatic action are carefully reviewed. As an example we may cite the theory of Arthus, who, relying upon the discrepancies which exist between the accounts of many authors as to the properties of the various diastases, takes up the position that enzymes are not substances, but are properties of substances. Enzymes, indeed, bring about chemical changes, but so also do light, heat and electricity. Magnetism is a property of magnetised substances such as steel, but it cannot be obtained apart from the substance. The same reasoning applies to enzymes, which are only the properties of the substances obtained by precipitation or other means, and therefore a pure enzyme is impossible. On p. 66 Dr. Effront shows

<sup>1</sup> "Entwurf eines natürlichen Systems der Thalamophoren." (*Nachrichten der K. Gesellsch. d. Wissenschaften zu Göttingen. Math.-phys. Klasse*, 1895, Heft 1, p. 63.)

The reader is left in doubt as to the precise term advocated by the author, for on p. 48 "dimorphous" is used, but on p. 164 the word has become "bimorphous."

<sup>2</sup> "Ein Mikroaquarium." (*Zeits. f. wiss. Mikroskopie*. Bd. xi., 1894, p. 326.)

how extremely sensitive the enzymes are to antiseptic and toxic substances; we have not heard of magnetism or electricity being affected in a like manner. But whatever the truth may be, it cannot but be admitted that our present knowledge as to what diastatic action really may be is incomplete and vague in the extreme. Possibly the elucidation of many of the difficulties will follow the preparation of a pure enzyme.

One difficulty encountered in studying the enzymes is the multitude of names which a single enzyme may possess, e.g. on p. 51 we are told that sucrase is variously called "glucose ferment, cytozymase, zymase and invertin." The chief reason for this diversity of names is that different investigators, having obtained from different sources a diastase capable of transforming cane sugar into invert sugar, have often been under the impression that they have come across a new diastase and have therefore invented a name for it.

Chapters v. and vi. deal with sucrase from a theoretical aspect, and chapter vii., on the fermentation of molasses, introduces us to the technical portion of the work. Although sucrase is not prepared commercially, it plays a very important part in fermentation, especially in the manufacture of alcohol from molasses.

Dr. Effront has evidently studied the technical part of the question with the same care which he has devoted to the scientific side. As a consequence the chapters on the technology of the enzymes should be very valuable to those interested in this branch of the subject. The space at our disposal forbids us to more than briefly notice some of the important applications of enzymic fermentation. There is an interesting chapter on "Panary Fermentation," and here one cannot but be struck by the fact that although the art of bread-making is one of great antiquity, yet we know very little as to what really does take place in the process of bread-making.

Chapter xviii. deals with the industrial application of "maltase" (the ferment of maize, which also occurs in small quantities in yeast) and the manufacture of glucose.

Chapter xxi. should be of great interest to chemists, as it treats of the "Ferments of Glycerides and Glucosides." Among the various enzymes here discussed, we notice "lipase," the active principle of the pancreatic juice, "emulsin," which occurs in almonds, and "erythrozyme," the ferment contained in the madder root. This chapter might with advantage have been extended, but, unfortunately, our knowledge of these very interesting substances is not yet very far advanced.

In conclusion, we must not forget the translator, Mr. Samuel C. Prescott, who has carried out his labours in a most satisfactory manner. F. MOLLWO PERKIN.

#### OUR BOOK SHELF.

*Astronomischer Jahresbericht.* By Walter F. Wislicenus. Band iii. Pp. xxxi + 671. (Berlin: Georg Reimer, 1902.)

THE value of this work to astronomers and others interested in astronomical matters is now so well known, in spite of this being only its third appearance, that the present issue will be warmly welcomed. In the compilation of such an undertaking as this, Dr. Wislicenus and his co-workers are to be heartily congratulated, for they

have brought together a very great number of most useful references and excellent brief extracts of all the more important publications of the past year. The volume now contains 671 pages, and the compiler informs us that this will probably be about its normal size. The second volume contained 552 references more than the first one, and the one before us shows an excess over the second by 193 references. This latter excess was chiefly due to the great number of papers on Nova Persei, which required 228 references alone. In future, to keep down the number of such references, the compiler proposes to include under one reference all those publications which appear during a year under the same heading and by the same author. This seems a very rational suggestion.

It may be mentioned that references are not only given to all the original publications, but also to all translations of such publications and astronomical articles which have appeared in various quarters. Thus, to take a case in point, we find that the communication by Dr. J. Hartmann to the *Sitz. der Kgl. preuss. Akademie der Wiss. zu Berlin* on "The movement of the Pole Star in the line of sight" was translated into English in the *Astrophysical Journal*, and was noticed in *Sirius*, *Die Natur*, *Astronomische Rundschau*, *Das Weltall* and the *Revue Scientifique*, their respective references being added in each case.

The book concludes with a capital index of names and brief tables of errata to the second and present volume. In addition to those mentioned in the present volume, which, by the way, are remarkably few in number considering the work involved, may be added "Norman" instead of "Normann" in references Nos. 1454 and 2131, and "nächste Maximum" instead of "jetzige Minimum" in reference number 1510.

In conclusion, it is hardly necessary to point out that no astronomical observatory or similar institution should be without this volume, which embodies in it all that relates to the recent progress of astronomical science, not only in this country, but over the whole world. That the work has in its third year become so complete is due to the untiring labours of Dr. Wislicenus and his co-compilers, and it is hoped that such may in the future be lightened by the endeavour of all interested in such a useful undertaking to remember to send them separate copies, reprints, &c., of published papers.

W. J. S. LOCKYER.

*Elements of Metaphysics.* By J. S. Mackenzie. Pp. xv + 172. (London: Macmillan and Co., Ltd., 1902.) Price 4s. 6d.

PROF. MACKENZIE is to be congratulated on having produced an exceedingly useful little book of a kind which has no precise counterpart in our current philosophical literature. Within the compass of less than two hundred small pages he deals very suggestively with the nature of the metaphysical problems, the methods of metaphysical science and its relation to the rest of our theoretical and practical interests, science in general, art, ethics, and religion. The aim of his discussion is not so much to indicate conclusions as to lead his reader to comprehend the nature of the problems to be solved and the methods of solution which are at our command. Hence the beginner in philosophy could hardly have a better introduction to what is, after all, the main business of philosophy, the practice of thinking intelligently for himself on the ultimate problems of knowledge. So far as the author's own conclusions in philosophy are put forward, they indicate a rare catholicity of view with a certain bias in favour of the line of thought, represented by Aristotle and Hegel among the great names of metaphysics, which insists upon development as the key to the understanding of the forms of existence. As might be expected from his choice of philosophical masters,